Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

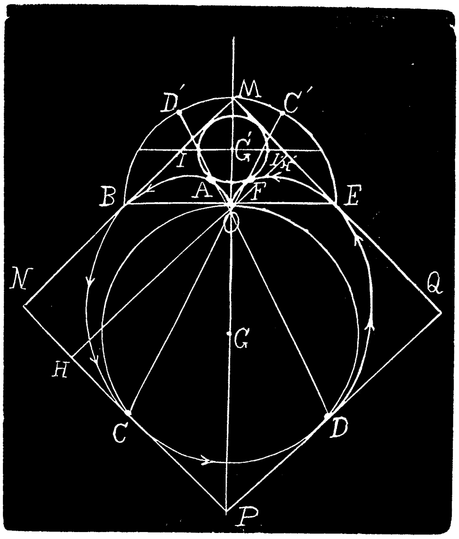
Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

Taken in the order of their magnitude, these values of θ represent the angular position of the points A, B, C, D, E, and F, with respect to the origin of polar co-ordinates and the axis of the cardioid If any tangents to the cardioid be drawn through *these* points, such tangents make angles of 45° with the axis MP. When the origin of polar co-ordinates is at O, the radius vectors of the points already specified becomes respectively:

$$OA=\tfrac{1}{2}(2-\sqrt{3})a,\ OB=a,$$
$$OC=\tfrac{1}{2}(2+\sqrt{3})a,\ OD=\tfrac{1}{2}(2+\sqrt{3})a,$$
$$OE=a, \text{ and } OF=\tfrac{1}{2}(2-\sqrt{3})a.$$

Consequently the area of the required circumscribing square $=(MN)^2=(OH+OH')^2$ $=\frac{9}{32}(3+\sqrt{3})^2a,=\frac{27}{16}(2+\sqrt{3})a^2\ldots.(2)$; and of this square, the diagonal MP $=\frac{3}{4}(3+\sqrt{3})a$. Since the *diagonal* $II'=\frac{3}{4}(3+\sqrt{3})a$, the area of the square the center of the inscribed circle of which is at $G'=(MI)^2=\frac{9}{32}(3-\sqrt{3})^2a^2$, $=\frac{27}{16}(2-\sqrt{3})a^2\ldots.(2)$.



Represent the area of the *larger* square by A and that of the *smaller* square by A'; then from the results given, $A:A'::(2+\sqrt{3}):(2-\sqrt{3})::OC:OF$.

IV. Second Solution by Professors F. P. MATZ; and C. E. WHITE, Trafalgar, Indiana.

The *pedal equation* of the cardioid in consideration, is $p^2=r^3/2a$; that is, for the points B, C, D, and E, we have respectively: $p_B=a/\sqrt{2}$, $p_C=\frac{1}{4}a\sqrt{(26+15\sqrt{3})}$, $p_D=\frac{1}{4}a\sqrt{(26+15\sqrt{3})}$, and $p_E=a/\sqrt{2}$. In order that the quadrilateral circumscribing the cardioid may be a square, we must have $p_B+p_D=p_C+p_E$; and this condition is fulfilled. Hence the *required* area becomes $A=(p_B+p_D)^2=(p_C+p_E)^2=\frac{27}{16}(2+\sqrt{3})a^2\ldots.(1)$,

while the area of the *smaller* square becomes

$$A'=(p_B-p_F)^2=(p_E-p_A)^2=\tfrac{27}{16}(2-\sqrt{3})a^2\ldots.(2).$$

NOTE—By using the equation $p=2a\sin^3\phi$, in which $\phi=\frac{1}{2}\theta$, a *third* solution can be made. Sufficient data are given in the problem to enable us to make a *fourth* solution, without having recourse to the differential calculus.

Also solved by *O. W. Anthony*, *H. W. Draughon*, and *J. B. Faught*. We regret that *Professor Faught's* solution was mislaid and could not be considered in selecting papers for publication.

PROBLEMS.

41. Proposed by F. P. MATZ, M. Sc., Ph.D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

The *closed portion* of the curve known as "The Cocked Hat," equation

$$x^4+x^2y^2+4ax^2y-2a^2x^2+3a^2y^2-4a^3y+a^4=0,$$

revolves around the axis of y. Find the *companulate* volume generated. If the same portion of the curve revolve around the axis of x, find the *fusiform* volume generated. Also, determine the area of this closed portion of the curve.

41. Proposed by F. M. SHIELDS, Coopwood, Mississippi.

A railroad turn-table 100 feet long is balanced upon a pivot in the center of a circular track 100 feet in diameter. How far does a man walk who starts at one end of the table and walks, at a uniform rate, the entire length of the table in the same time that the table makes two revolutions, if the table starts to turn at the same time the man starts to walk?

MECHANICS

Conducted by B.F.FINKEL, Kidder, Missouri. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

16. Proposed by A. H. BELL, Hillsboro, Illinois.

An iron bar 20 feet long and weighing 2,000 lbs, leans against a wall at angles of 30°, 45°, and 80°. Determine the *pressure* upon the floor, and *that* upon the wall.

I. Solution by F. P. MATZ, M. Sc., Ph.D.. Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

Let P_F=the pressure upon the floor, and P_W=the pressure upon the wall, then, if θ be the angle the bar makes with ths vertical wall, we have from *Wood's Analytical Mechanics*, the equations:

$P_F=-W=-2000$ lbs; that is, the floor sustains the whole weight of the bar, and $P_W=\frac{1}{2}W\tan\theta$....(1).

According to the conditions of the problem, we deduce from (1) the following results:

For $\theta=1°$, we have $P_W=$ 17.455054+ lbs;
" " $=10°$, " " " $=$ 176.327696+ " ;
" " $=30°$, " " " $=$ 577.350266+ " ;
" " $=45°$, " " " $=$1000.000000+ " ;
" " $=60°$, " " " $=$1732.050800+ " ;
" " $=80°$, " " " $=$5671;280256+ " ;
" " $=89°$, " " " $=$5728.996052+ " ;

NOTE.—How the *last two* results, and all *succeeding* results to the limit of the quadrant, are to be interpreted, is a question on which Professor DeVolson Wood can *interest* the readers of the MONTHLY.

II. Solution by EDMOND FISH, Hillsboro, Illinois.

It must be assumed that the bar is prevented from sliding down by some lateral resistance, either the roughness of the floor, or some object, as a